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Production Costs in the Manufacture of Phonograph Records

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PRODUCTION COSTS IN THE MANUFACTURE OF PHONOGRAPH RECORDS

In devising a successful cost accounting system for a particular plant or industry, the most important requisite is a thorough understanding of every manufacturing process and condition encountered in that particular plant or industry.

In the production of phonograph records there are relatively few manufacturing processes, but there are some conditions in connection with this industry which are somewhat troublesome from a cost accounting point of view. This industry affords a very unsatisfactory field of endeavor for the purely theoretical cost accountant, since there are some factors which if treated in a manner theoretically correct would be highly complicated and the results secured would mean little and be worth less to the plant executives.

DEPARTMENTS

A plant manufacturing phonograph records consists of three principal departments as follows: (1) The recording laboratory, (2) the electroplating department, and (3) the record department.

RECORDING LABORATORY

The recording laboratory of practically every one of the record manufacturing concerns is located in New York City, although some recording is done in Chicago and in some other of the larger cities. The condition which makes New York City the center of this work is the fact that the industry is almost entirely dependent upon the theatrical profession for its artists or talent. New York City is the recognized center for this profession in the United States.

The product turned out or produced by the Recording Laboratory is the Recorded Wax. The process of producing this wax is as follows: The blank wax upon which the instrumental or vocal sounds or tones are to be recorded is compounded or prepared chiefly from paraffine and beeswax together with some other chemicals. These materials are cooked or heated and then the resulting mixture is poured into cylindrical moulds and allowed to cool. Then this hardened wax is removed from the mould and one side of it upon which the recording is to be made is shaved until it is perfectly smooth. These waxes are usually from twelve to fourteen inches in diameter, and from one and one-half to three inches in thick-

ness. They are then ready for use on the recording machine. This machine is similar in principle to the ordinary phonograph, but is operated in exactly the reverse manner.

In the operation of the ordinary phonograph the finished record is placed upon the revolving turntable of the machine, and the lower point of a needle is placed in a groove engraved or pressed upon the surface of the record. This groove contains tiny projections which cause the needle to vibrate as the record revolves. The upper end or point of the needle is attached to a thin sheet of mica or other similar material, and the vibrations of the needle also cause this sheet known as the Diaphragm to vibrate, and these vibrations are then intensified or amplified through the sound or tone chamber of the machine. These vibrations then cause sound waves which likewise cause the diaphragm in the ear of the hearer to vibrate, and the person hears a reproduction of the tones or sounds from which the record was originally made.

Now in the making of the recording the blank wax described above is placed upon the turntable of the recording machine and the lower point of the needle is placed upon the smooth surface of the wax. Then the machine is placed in operation while the sounds or tones which it is desired to record are directed into the sound or tone chamber of the machine. The sound waves caused by the instrument or voice tones are transmitted to the diaphragm of the machine causing this diaphragm to vibrate and in turn these vibrations are transmitted to the upper point of the needle attached to the diaphragm. The lower point of the needle then carves a groove upon the blank wax, and the edges or bottom of this groove will contain tiny projections caused by the vibration of the needle. The needle is guided so that a continuous spiral groove is made around and around the wax as it revolves. As a rule the needle is started on the outer edge of the wax and travels toward the center, but in some foreign-made records exactly the reverse procedure is followed, the recording starting at the center of the record and moving toward the outer edge. This completes the work of the recording laboratory, although usually two recorded waxes are made of each recording, since these waxes are easily spoiled, thus affording a protection against the complete loss of the recording through the damaging of one recorded wax. Each recording is serially numbered, and a report is sent to the plant of the talent cost in connection with each recording, together with the general operating costs of the recording laboratory. The form of this report will be shown and discussed later.

After these waxes are recorded, they are carefully packed and shipped to the plant, where they are delivered to the Electroplating Department.

Electroplating Department

In the Electroplating Department the recorded wax is chemically treated so that it becomes receptive to being electroplated, which is done, thus producing a shell of nickel or other metal. This

shell is then removed from the wax. Only one shell can be secured from each wax as the grooves on the wax are damaged in removing the first shell. This metal shell is called the Master Plate, and is a negative of the wax since what were grooves on the wax become ridges or projections on the Master Plate. This plate must be handled very carefully since a slight blow or pressure upon its surface would be very likely to damage the ridges or projections on it.

The Master Plate is now chemically treated and then nickel plated. Because of the treatment before plating, the new shell is easily removed. This shell or plate is a duplicate of the original wax and is called the Mother Plate. As a rule two or more Mother Plates may be made from one Master Plate. In a similar manner another shell is made from each Mother Plate. These last shells or plates are called Pressing Matrices, as they are used as dies in producing the finished record.

It will be seen that these Pressing Matrices are a negative of the finished record and of the recorded wax, since what were grooves on the Mother Plate become ridges on this plate. The pressing matrix shell is then cemented on a copper plate or back to make it more substantial and capable of having force or weight applied to it without danger of bending or perforating the shell.

The Pressing Matrix is the finished product of the Electroplating Department, as the master and mother shells are simply intermediate steps between the Recorded Wax and the Finished Pressing Matrix.

The materials used by the Electroplating Department are chiefly plating materials, cleaning supplies, cement or solder, and the copper backs. These backs are capable of being used several times, as the shell is usually worn out or damaged before the back is worn or damaged at all, so the old shell is removed and the back is ready to be attached to a new Matrix shell.

Record Department

As the Pressing Matrices are finished they are ready for use in the Record Department. The Recording Department really consists of five small departments, which are as follows:

The Stock Preparing Department, the Record Pressing Department, the Record Inspection Department, the Record Edging Department, and the Finished Record Stock Department.

In the Stock Preparing Department the various materials used in making the stock, of which the finished record consists, are ground, pulverized and then mixed together according to carefully guarded formulas. The materials used are generally designated by code numbers or letters so the workmen employed in this department do not even know what all the materials are. Large amounts of money are expended by record manufacturers in experimenting with different materials in their attempt to produce a stock which will make a durable yet scratchless sounding record.

The record stock after being mixed is then cooked and kneaded between steam heated rolls. Then it is fed through a blanking machine which rolls it out into a thin layer and cuts it into squares or blanks about one-fourth of an inch thick and eight inches square. These blanks are then placed on tables or racks and cooled. They are then ready for use in the Record Pressing Department.

In the Pressing Department, the Pressing Matrices are received from the Electroplating Department. Each matrix contains the imprint for one face or side of the finished record. Therefore to produce an ordinary double faced record two pressing matrices are used. The record is produced on a machine known as a Record Press. This machine is like a vise in principle, there being two jaws or heads which are opened and closed by the use of hydraulic power usually. In the manufacture of a record the jaws of the press are opened and a pressing matrix is clamped on the lower side of the upper jaw, and another on the upper side of the lower jaw. Next a blank of record stock as produced in the Stock Preparing Department is placed on a steam table and heated until it becomes soft and pliable. Then this blank is placed on the center of the pressing matrix clamped to the lower jaw of the press. A record label is next placed on each side of this record stock and the jaws of the press are forced together which flattens the record stock out between the two pressing matrices. Then steam is circulated around through the jaws of the press which heats the record stock so that the impression of the two matrices is made on the stock. After the jaws have been closed for a short time, probably a half minute, the steam is shut off and cold water circulates through the jaws of the press cooling the plates and the record. When they are thoroughly cooled, which likewise may take a half minute, the jaws are released and the labeled record lies upon the lower plate or it may sometimes adhere to the upper plate, but is usually removed easily if the press is properly operated and the plates properly installed. The record is then placed in a container and the workman proceeds with the making of another record.

Inspection Department

The records are taken from the Pressing Department to the Inspection Department where they are examined for imperfections. Many of them are actually played on a phonograph to detect imperfections which might not be visible to the naked eye. In this way many imperfect and damaged records are thrown out. These defective records are sent to the Stock Preparing Department, previously discussed, where they are ground and pulverized and again used in the manufacture of the record blanks or squares.

Edging Department

After the accepted records have left the inspectors they are sent to the Edging Department, where they are clamped to the revolving spindle of a lathe and the edges smoothed or finished with

sand paper or emery blocks, thus completing the production of the finished record.

After this operation the finished records are sent to the Finished Record Stock Department where they are placed in individual pockets or envelopes and filed in labeled stock bins or drawers to be withdrawn by the shipping clerk as the sales orders are packed for shipment.

Having thus traced the movement of the sound vibrations or waves from the time they leave the artist's lips or instrument until they are permanently engraved upon the finished record ready for sale, the next step is to trace the accounting procedure in collecting and recording the costs of producing the finished record.

Recording Laboratory Costs

The costs incurred in the operation of the Recording Laboratory are classified under two headings, namely, General and Direct. The direct recording costs include those expenditures made for the benefit of a particular recording, which are primarily the payments made to the artists. All other costs of the recording laboratory are classed as general or indirect, and include chiefly the rental expense for the space occupied, cost of recording materials and supplies, salaries of the recording manager and his staff, and depreciation on the equipment.

These costs are collected and exhibited on a report similar to that shown in Form No. 1, (see page 8). This report is compiled monthly. It will be noted from this report that the total general or indirect expenses are spread equally over all recordings made during the month.

Electroplating Department

The cost of operating the Electroplating Department are collected from Material Requisitions, Labor Reports, and the Overhead Distribution Schedule in the usual manner. Then these costs are entered on a cost exhibit for this department similar to that shown in Form 2, (see page 9).

In the Electroplating Department costs, no recognition is made of the value of the work in process at the beginning and ending of cost periods as this amount is relatively small and is practically the same at all times. The output or production of this department is the number of plates backed and delivered to the Pressing Room during the month. The total charges to the Electroplating Department for the month are borne by the output, thus in the case shown in Form No. 2 an average cost of $3.47½ was ascertained.

Record Department Costs

The costs of the Record Department, which as previously outlined includes the stock mixing, pressing, inspecting, edging and stocking, are collected from Material Requisitions or Reports, Labor Reports, and the Overhead Distribution Schedule in the customary manner. These costs are then entered on a Cost Exhibit

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Exhibit of Recording Laboratory Costs

For the month ending_____

Expenses:	
Salaries	$ 650 00
Rent	300 00
Light, Heat, and Power	12 00
Recording Supplies	38 00
Office Supplies	10 00
Depreciation	12 00
Talent	1200 00
Total Recording Costs	$2222 00

Distribution

Recordings	Talent	Indirect	Total
No. 1201	$ 75 00	$ 102 20	$ 177 20
" 1202	50 00	102 20	152 20
" 1203	100 00	102 20	202 20
" 1204	125 00	102 20	227 20
" 1205	100 00	102 20	202 20
" 1206	75 00	102 20	177 20
" 1207	225 00	102 20	327 20
" 1208	175 00	102 20	277 20
" 1209	125 00	102 20	227 20
" 1210	150 00	102 20	252 20
Totals	$1200 00	$ 1022 00	$ 2222 00

Form No. 1.

similar to that shown in Form No. 3, (see page 10). As in the Electroplating Department, no recognition is given in this department to the value of work in process at the beginning and ending of cost periods, as this amounts to practically nothing. Therefore the total charges to the department during the month are borne by the output of finished accepted records put into stock during the month.

THE BLANK RECORD COMPANY

Exhibit of Electroplating Department Costs

For the month ending_____

Costs:		
Material - - - - - - - - - - - -	$ 650	00
Labor- - - - - - - - - - - - - -	450	00
Overhead - - - - - - - - - - - -	290	00
Total Costs- - - - - - - - -	$ 1390	00
Pressing Matrices Produced	400	
Average cost per matrix- -	3	47½

Form No. 2.

The greatest problem in accounting for costs in the record industy is the proper distribution of costs and the inclusion of the Recording and Electroplating costs in the cost of the finished records.

It has been found extremely burdensome and practically valueless to keep complete cost records for each recording as will be readily apparent from the following illustration: Recording No. 1201 was recorded at a cost of $177.20 as shown by Form No. 1, and from it eight pressing matrices were made at an additional cost of $3.47½ each or a total cost of $27.80, thus making a total recording and electroplating cost for this recording of $205. Now, during this particular month, 2,000 records were finished from this recording at a record department cost of .1515 each as shown by Form No. 3, or a total cost of $303.00. Therefore the entire cost of these 2,000 records is $508, if no more records are made, thus making an average cost per record of 25 4/10 cents. Now in the following month it may be found advisable to press 1,000 more

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Exhibit of Record Department Costs

For the month ending _____

Direct Material:				
Record Stock	$2400	00		
Labels	350	00	$2750	00
Direct Labor:				
Stock Mixing	$ 400	00		
Pressing	1000	00		
Inspecting	200	00		
Edging	300	00		
Stocking	250	00	2150	00
Overhead:			1160	00
Total Costs			$6060	00
Accepted Records Produced			40000	
Average Cost per record			$ .1515	

Form No. 3.

finished records from this recording, and accordingly four more pressing matrices were made in the electroplating department at a total cost of $15, and the 1,000 records were gnished at a record department cost of $160. Now since the the total recording cost of this record was included in the costs of the records produced during the preceding month, the total cost of these 1,000

records would only be $174, or an average record cost of $17.-4/10 cents. From the foregoing illustration it is easily seen what details and varying costs are encountered in figuring costs by recordings, although this is theoretically the correct method.

THE BLANK RECORD COMPANY

Ledger showing number of records pressed from each Recording discontinued from Catalog together with the average number of records from all discontinued recordings.

Recording No.	Dates		Number of Records		
	Recorded	Disconti'd.	Total	Accumultd.	Ave.
1	1-4-'12	7-4-'15	1000	1000	1000
2	1-5-'12	7-4-'15	5000	6000	3000
3	1-6-'12	7-4-'15	6000	12000	4000

Form No. 4.

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Ledger showing number of records pressed from each discontinued recording with the number of pressing matrices used and the average number of records pressed from each matrix.

Recording No.	Matrices		Records.		
	Total	Accumultd.	Total	Accumulted.	Ave.
1	8	8	1000	1000	125
2	22	30	5000	6000	200
3	30	60	6000	12000	200

Form No. 5.

The only method whereby the above burdensome details and useless varying costs may be eliminated and accurate valuable costs secured is to institute records whereby the average number of records made from each recording may be ascertained. Such a record is illustrated by Form No. 4, (see page 11). This form shows that the average number of records produced from each discontinued recording to date is 4,000. This is ascertained by dividing the total number of records made from all discontinued recordings by the number of such recordings.

Likewise in the Electroplating Department costs, a ledger must be operated to show the average number of records secured from each pressing matrix. Such a record is illustrated by Form No. 5, (see page 11). This record shows that the average number of records produced from each matrix on the discontinued recordings to date is 200. This is ascertained by dividing the total number of records made from the discontinued recordings by the number of plates or matrices used.

A ledger must also be operated which will show the average cost of recordings made together with the average cost of recordings which have not been charged into the cost of Finished Records. This ledger is illustrated by Form No. 6, (see page 13).

Likewise a ledger must be operated which will show the average cost of all pressing matrices made together with the average cost of matrices which have not been charged into the cost of Finished Records. This ledger is illustrated by Form No. 7, (see page 13).

Now from the average number of records produced from each recording as shown by Form No. 4, and the average cost of unused recordings as shown by Form No. 6, the amount of recordings costs to be included in the cost of the 40,000 records produced during the current month is ascertained as follows:

$$\frac{40{,}000 \text{ Records} \times 2}{4{,}000 \text{ Records}} \text{ equals } 20 \text{ records.}$$

20 Recordings $\times$ \$200.00 equals \$4,000.00, the amount of recording costs to be included in the finished record costs for the month.

Likewise from the average number of records produced from each pressing matrix as shown by Form No. 5, and the average cost of unused matrices on hand as shown by Form No. 7, the amount of Electroplating costs to be included in the cost of the 40,000 records finished during the month is ascertained as follows:

$$\frac{40{,}000 \text{ Records} \times 2}{200 \text{ Records}} \text{ equals } 400 \text{ matrices.}$$

400 Matrices $\times$ \$3.50 equals \$1,400.00, the amount of Electroplating costs to be included in the finished record costs for the month.

In ascertaining the number of recordings and the number of

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Ledger showing average cost of all recordings together with the cost of unused recordings yet to be included in Finished Record Costs.

Recordings				To Finished Record Costs.				Balance of Unused Recordings.			
Date	No.	Price	Total	Date	No.	Price	Total	Date	No.	Price	Total
1912				1912				1912			
1-31	8	312.50	2500.00	1-31	4	312.50	1250.00	1-31	4	312.50	1250.00
2-28	15	200.00	3000.00	2-28	8	223.70	1789.60	2-28	11	223.67	2460.40
3-31	12	175.00	2100.00	3-31	10	198.25	1982.50	3-31	13	198.30	2577.90

Form No. 6.

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Ledger showing average cost of all pressing matrices made together with the cost of unused matrices yet to be included in Finished Record Costs.

Matrices Made.				To Finished Record Costs.				Balance of Unused Matrices.			
Date	No.	Price	Total	Date	No.	Price	Total	Date	No.	Price	Total
1912				1912				1912			
1-31	30	800	240.00	1-31	20	800	160.00	1-31	10	800	80.00
2-28	150	700	1050.00	2-28	90	706	635.40	2-28	70	707	494.60
3-31	250	250	625.40	3-31	200	350	700.00	3-31	120	350	420.00

Form No. 7.

matrices chargeable to record costs for the month it is necessary to double the number of records produced during the month since two recordings and two matrices are used in producing one double faced record.

Now from Form No. 3 and the above calculations, the total cost of the 40,000 records produced during the current month is ascertained and exhibited as follows:

Complete Record Costs for the Month.

	Total	*Each*
Recording Costs	$ 4000.00	.1000
Electroplating Costs	1400.00	.0350
Record Department Costs	6060.00	.1515
Total	$11,460.00	.2865

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